

**WHAT IS CLAIMED IS:**

1           1.       A method of processing a series of write requests originated by one or more  
2 applications running on one or more host computers coupled to a memory subsystem, the  
3 series of write requests comprising data to be written to storage media comprising the  
4 memory subsystem, said method comprising the steps of:

5               pooling one or more of the series of write requests in a write cache of the memory  
6               subsystem;

7               delaying communication of write acknowledgements generated by the memory  
8               subsystem for each of the write requests comprising a current pool until the  
9               data of all of the pooled requests has been written to the storage media; and

10              flushing the cache, when the current pool reaches the appropriate size, to store the  
11              data of all of the write requests comprising the current pool to the storage  
12              media.

1           2.       The method of Claim 1 wherein said step of pooling is performed in  
2 accordance with a write-back caching process.

1           3.       The method of Claim 1 wherein said step of flushing the cache is initiated  
2 through one more software commands.

1           4.       The method of Claim 1 wherein the memory subsystem comprises one or  
2 more disk drives and the storage media comprises one or more magnetic disks.

1           5.       The method of Claim 4 wherein the write cache is located in the one or more  
2 disk drives.

1           6.       The method of Claim 1 wherein said method further comprises the step of  
2 monitoring the series of write requests to determine the appropriate pool size for a current  
3 pool.

7. The method of Claim 6 wherein said monitoring step further comprises the steps of:

- maintaining the write requests received from the applications in an incoming request queue;
- determining whether a write request is pending in the incoming request queue;
- determining whether a predetermined maximum pool size has been met or exceeded by the current pool;
- issuing a next write request pending in the incoming request queue to be processed by said pooling step if a request is pending and the predetermined maximum pool size has not been met or exceeded by the current pool; and
- otherwise proceeding to said step of flushing the cache.

8. The method of Claim 7 wherein said monitoring step further comprises the steps of:

- assessing the degree to which any write requests pending in the incoming request queue are related to those already comprising the current pool ; and
- wherein said issuing step further comprises the step of permitting the maximum pool size to be exceeded when any pending write requests are assessed to be sufficiently related to those write requests already comprising the current pool.

9. The method of Claim 8 wherein said assessing step further comprises the step of determining that the write requests are sufficiently related if they are continuous with one another or continuous with one or more of the write requests already comprising the current pool.

10. The method of Claim 8 wherein said assessing step further comprises the step of determining that the write requests are sufficiently related if the disk addresses of one or more of the pending requests are within some predetermined range of one or more of the requests already comprising the current pool.

1           11.     The method of Claim 7 wherein said monitoring step further comprises the  
2 steps of:  
3           waiting a predetermined time for a write request to be received by the incoming  
4           request queue whenever no write requests are determined to be pending in the  
5           incoming request queue and the predetermined maximum pool size has not  
6           been met or exceeded by the current pool; and  
7           otherwise proceeding to the step of flushing the cache.

1           12.     The method of Claim 7 wherein said step of pooling is performed in  
2 accordance with a write-back caching process and said step of issuing a next write request  
3 further comprises the step of delaying the issuing of the next write request until the write-  
4 back caching process has been completed for a most recently issued write request.

1           13.     The method of Claim 7 wherein the predetermined maximum pool size is four  
2 to five write requests.

1           14.     The method of Claim 1 wherein said step of flushing the cache further  
2 comprises arranging the order in which each request in the current pool is written to the  
3 storage media to minimize the time required to perform said step of flushing the cache.

1           15.     The method of Claim 1 wherein said step of flushing the cache further  
2 comprises the step of identifying the write requests comprising the current pool as those  
3 stored in write cache entries marked dirty.

1           16.     The method of Claim 1 wherein said step of delaying communication further  
2 comprises the step of communicating the write acknowledgements for each of the write  
3 requests comprising the current pool to each of the originating one or more applications upon  
4 receiving a notification from the memory subsystem that the flushing process has been  
5 completed.

1           17.     The method of Claim 1 wherein said steps of pooling, delaying, monitoring  
2 and issuing are performed by software residing in association with the host computer.

1           18.     The method of Claim 1 wherein said steps of pooling, delaying, monitoring  
2     and issuing are performed by software residing in association with a disk controller of the  
3     memory subsystem.

1           19.     The method of Claim 1 wherein said steps of pooling, delaying, monitoring  
2     and issuing are performed by software residing in association with an array processor of the  
3     memory subsystem.

1           20.     The method of Claim 1 wherein two or more hosts are coupled to the memory  
2     subsystem using a network.

1           21.     The method of Claim 20 wherein the network is a shared network.

1           22.     A computer system for processing a series of write requests originated by one  
2     or more applications running on one or more host computers coupled to a memory  
3     subsystem, the series of write requests comprising data to be written to storage media in the  
4     memory subsystem, said computer system comprising:

5           a memory means for storing program instructions for:  
6           pooling one or more of the series of write requests in a write cache of the memory  
7           subsystem;  
8           delaying communication of write acknowledgements generated by the memory  
9           subsystem for each of the write requests comprising a current pool until the  
10          data of all of the pooled requests has been written to the storage media; and  
11          flushing the cache, when the current pool reaches the appropriate size, to store the  
12          data of all of the write requests comprising the current pool to the storage  
13          media; and  
14          means for processing said program instructions.

1           23.     The computer system of Claim 22 wherein said pooling is performed in  
2     accordance with a write-back caching process.

24. The computer system of Claim 22 wherein said flushing the cache is initiated through one more software commands.

25. The computer system of Claim 22 wherein the memory subsystem comprises one or more disk drives and the storage media comprises one or more magnetic disks.

26. The computer system of Claim 25 wherein the write cache is located in the one or more disk drives.

27. The computer system of Claim 22 wherein said program instructions are further for monitoring the series of write requests to determine the appropriate pool size for a current pool.

28. The computer system of Claim 27 wherein said program instructions are further for:

- maintaining the write requests received from the applications in an incoming request queue;
- determining whether a write request is pending in the incoming request queue;
- determining whether a predetermined maximum pool size has been met or exceeded by the current pool;
- issuing a next write request pending in the incoming request queue to be processed by said pooling step if a request is pending and the predetermined maximum pool size has not been met or exceeded by the current pool; and
- otherwise proceeding to said step of flushing the cache.

29. The computer system of Claim 28 wherein said program instructions are further for:

- assessing the degree to which any write requests pending in the incoming request queue are related to those already comprising the current pool ; and
- wherein said issuing step further comprises the step of permitting the maximum pool size to be exceeded when any pending write requests are assessed to be sufficiently related to those write requests already comprising the current pool.

30. The computer system of Claim 29 wherein said program instructions are further for determining that the write requests are sufficiently related if they are continuous with one another or continuous with one or more of the write requests already comprising the current pool.

31. The computer system of Claim 29 wherein said program instructions are further for determining that the write requests are sufficiently related if the disk addresses of one or more of the pending requests are within some predetermined range of one or more of the requests already comprising the current pool.

32. The computer system of Claim 28 wherein said program instructions are further for:  
waiting a predetermined time for a write request to be received by the incoming request queue whenever no write requests are determined to be pending in the incoming request queue and the predetermined maximum pool size has not been met or exceeded by the current pool; and  
otherwise proceeding to the step of flushing the cache.

33. The computer system of Claim 28 wherein said step of delaying communication further comprises the step of communicating the write acknowledgements for each of the write requests comprising the current pool to each of the originating one or more applications upon receiving a notification from the memory subsystem that the flushing process has been completed.

34. The computer system of Claim 28 wherein said pooling is performed in accordance with a write-back caching process and said issuing a next write request further comprises the step of delaying the issuing of the next write request until the write-back caching process has been completed for a most recently issued write request.

35. The computer system of Claim 22 wherein two or more hosts are coupled to the memory subsystem using a network.

1           36.     The computer system of Claim 35 wherein the network is a shared network.

1           37.     The computer system of Claim 22 wherein said flushing the cache further  
2 comprises arranging the order in which each request in the current pool is written to the  
3 storage media to minimize the time required to perform said step of flushing the cache.

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